

AMENDMENTS TO THE CLAIMS

Please amend claims 1, 4, 5, 8, and 14-27 as follows:

1. (Currently Amended) A method of controlling a conductivity of a Ga₂O₃ system single crystal, comprising:

adding ~~[[a]]~~ an n-type predetermined dopant to the Ga₂O₃ system single crystal ~~such that said dopant is substituted for Ga in the Ga₂O₃ system single crystal to~~ change a resistivity of said Ga₂O₃ system single crystal linearly with an added amount of the n-type dopant ~~obtain a desired conductivity,~~

wherein said n-type predetermined dopant comprises ~~one of:~~ an n-type dopant for controlling said conductivity of the Ga₂O₃ system single crystal comprising one of Zr, Si, Hf, Ge, Sn, and Ti; ~~said conductivity of the Ga₂O₃ system single crystal being controlled depending on an adding amount of said n-type dopant; and a p-type dopant for controlling said conductivity of the Ga₂O₃ system single crystal comprising one of H, Li, Na, K, Rb, Cs, Fr, Be, Ca, Sr, Ba, Ra, Mn, Fe, Co, Ni, Pd, Cu, Ag, Au, Zn, Cd, Hg, Tl, and Pb, said conductivity of the Ga₂O₃ system single crystal being controlled depending on an adding amount of said p-type dopant, and wherein a purity of said system single crystal is 6N.~~

2. – 3. (Canceled).

4. (Currently Amended) The method of controlling a conductivity of a Ga₂O₃ system single crystal according to claim 1, wherein a value of 2.0×10^{-3} to $8.0 \times 10^2 \Omega\text{cm}$ is obtained as the ~~a desired~~ resistivity by said ~~adding a predetermined amount of~~ said n-type dopant.

5. (Currently Amended) The method of controlling a conductivity of a Ga_2O_3 system single crystal according to claim 4, wherein a carrier concentration of the Ga_2O_3 system single crystal is controlled to fall within a range of 5.5×10^{15} to $2.0 \times 10^{19}/\text{cm}^3$ as a range of the ~~desired~~ resistivity.

6. – 7. (Canceled).

8. (Currently Amended) The method of controlling a conductivity of a Ga_2O_3 system single crystal according to claim 1, wherein said Ga_2O_3 system single crystal is prepared with a Ga_2O_3 polycrystalline raw material, and

wherein the Ga_2O_3 polycrystalline raw material has a purity of $6\text{N} \pm 1 \times 10^3$ ~~Ωcm or more~~ is
~~obtained as a desired resistivity by adding a predetermined amount of said p-type dopant.~~

9. – 13. (Canceled).

14. (Withdrawn – Currently Amended) A light emitting element, comprising:

an n-type $\beta\text{-AlGaO}_3$ cladding layer, an active layer, a p-type $\beta\text{-AlGaO}_3$ cladding layer, and a p-type $\beta\text{-Ga}_2\text{O}_3$ contact layer respectively laminated in order on an n-type $\beta\text{-Ga}_2\text{O}_3$ substrate contact layer, ~~said n-type p-type $\beta\text{-Ga}_2\text{O}_3$ contact layer and said n-type $\beta\text{-Ga}_2\text{O}_3$ substrate comprising made of~~ a $\beta\text{-Ga}_2\text{O}_3$ single crystal;

a transparent electrode and a pad electrode respectively formed in order on said p-type $\beta\text{-Ga}_2\text{O}_3$ contact layer; and

an n-side electrode formed ~~[[over]]~~ under a lower surface of said n-type $\beta\text{-Ga}_2\text{O}_3$ substrate contact layer,

wherein a ~~desired~~ resistivity of said β -Ga₂O₃ single crystal is in a range of 2.0×10^{-3} to $8.0 \times 10^2 \Omega\text{cm}$ obtained,

wherein a ~~purity~~ carrier concentration of said β -Ga₂O₃ single crystal is within a range of 5.5×10^{15} to $2.0 \times 10^{19}/\text{cm}^3$ [[6N]],

wherein said n-type layers comprise a dopant including one of Si, Zr, Hf, Ge, Sn, and Ti, and

wherein said p-type layers comprise a dopant including one of H, Li, Na, K, Rb, Cs, Fr, Be, Ca, Sr, Ba, Ra, Mn, Fe, Co, Ni, Pd, Cu, Ag, Au, Zn, Cd, Hg, Tl, Mg, and Pb [[Rb]].

15. (Withdrawn – Currently Amended) The light emitting element of claim 14, wherein a carrier concentration of said p-type β -Ga₂O₃ contact layer is greater than that of said p-type β -AlGaO₃ cladding layer; and

wherein a carrier concentration of said n-type β -Ga₂O₃ ~~contact layer~~ substrate is greater than that of said n-type β -AlGaO₃ cladding layer.

16. (Currently Amended) A method of controlling a conductivity of a Ga₂O₃ system single crystal, comprising:

contacting a Ga₂O₃ polycrystalline raw material comprising adding a predetermined dopant to
[[the]] a Ga₂O₃ system single seed crystal; and

growing the Ga₂O₃ system single crystal on the Ga₂O₃ seed crystal such that said predetermined dopant is substituted for Ga in the Ga₂O₃ system single crystal to obtain a desired resistivity in the Ga₂O₃ system single crystal of $1 \times 10^3 \Omega\text{cm}$ or greater conductivity,

wherein said predetermined dopant comprises a p-type dopant for controlling said conductivity of the Ga₂O₃ system single crystal, said p-type dopant comprising one of H, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Ra, Mn, Fe, Co, Ni, Pd, Cu, Ag, Au, Zn, Cd, Hg, Tl, and Pb, ~~said~~

~~conductivity of the Ga₂O₃ system single crystal being controlled depending on an adding amount of said p type dopant, and wherein a purity of said Ga₂O₃ system single crystal is 6N.~~

17. (Currently Amended) The light emitting element ~~method of controlling said conductivity of said Ga₂O₃ system single crystal according to claim 14 [[16]], wherein the active layer comprises β -GaInO₃ predetermined dopant comprises one of: said p type dopant; and an n type dopant for controlling said conductivity of the Ga₂O₃ system single crystal.~~

18. (Currently Amended) The method of controlling a conductivity of a Ga₂O₃ system single crystal according to claim [[17]] 16, wherein said Ga₂O₃ polycrystalline raw material has a purity of 6N ~~n-type dopant comprises one of Si, Hf, Ge, Sn, Ti, and Zr.~~

19. (Currently Amended) ~~[[The]]~~ A method of manufacturing ~~controlling a conductivity of a Ga₂O₃ system single crystal according to claim 17, comprising: wherein a value of 2.0×10^{-3} to $8.0 \times 10^2 \Omega\text{cm}$ is obtained as a desired resistivity by~~

~~adding a predetermined amount of said an n-type dopant to the Ga₂O₃ system single crystal, the n-type dopant comprising one of Zr, Si, Hf, Ge, Sn, and Ti; and~~

~~manufacturing the Ga₂O₃ system single crystal having a resistivity depending on an added amount of the n-type dopant by changing the resistivity of the Ga₂O₃ system single crystal linearly with the added amount of the n-type dopant.~~

20. (Currently Amended) ~~The method of forming a~~ A Ga₂O₃ system single crystal layer according to claim 19, comprising:

an n-type dopant, said n-type dopant comprising one of Zr, Si, Hf, Ge, Sn, and Ti; and
wherein

a carrier concentration of the Ga₂O₃ system single crystal is controlled to fall within a range of 5.5×10^{15} to 2.0×10^{19} /cm³ as a range of said desired resistivity that depends on an added amount of said n-type dopant such that the added amount of the n-type dopant changes the resistivity linearly.

21. (Currently Amended) The method of controlling a conductivity of a Ga₂O₃ system single crystal according to claim 16, wherein said conductivity of the Ga₂O₃ system single crystal is exclusively dependent on an added amount of 1×10^3 Ωcm or more is obtained as a desired resistivity by adding a predetermined amount of said p-type dopant.

22. (Currently Amended) A light emitting element method of controlling a conductivity of a Ga₂O₃ system single crystal, comprising:

an n-type β-Ga₂O₃ contact layer, an n-type β-AlGaO₃ cladding layer, an active layer, a p-type β-AlGaO₃ cladding layer, and a p-type β-Ga₂O₃ contact layer respectively laminated in order on an insulation type β-Ga₂O₃ substrate, said p-type β-Ga₂O₃ contact layer, said n-type β-Ga₂O₃ substrate, and said insulation type β-Ga₂O₃ substrate comprising a β-Ga₂O₃ single crystal;

a transparent electrode and a pad electrode respectively formed in order on said p-type β-Ga₂O₃ contact layer; and

an n-side electrode formed on said n-type β-Ga₂O₃ contact layer adding a predetermined dopant to the Ga₂O₃ system single crystal such that said dopant is substituted for Ga in the Ga₂O₃ system single crystal to obtain a desired conductivity,

wherein said predetermined dopant comprises a p-type layers comprise a dopant including for controlling said conductivity of the Ga₂O₃ system single crystal, said p-type dopant comprising one

of H, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Ra, Mn, Fe, Co, Ni, Pd, Cu, Ag, Au, Zn, Cd, Hg, Tl, and Rb [[Pb]],

wherein said n-type layers comprise a dopant including one of Si, Hf, Ge, Sn, Zr, and Ti ~~said conductivity of the Ga₂O₃ system single crystal being controlled depending on an adding amount of said p-type dopant, and~~

wherein a resistivity of said insulation type β -Ga₂O₃ substrate is $1 \times 10^3 \Omega\text{cm}$ or greater ~~said desired conductivity is dependent upon an amount of said predetermined dopant added to said Ga₂O₃ system single crystal.~~

23. (Currently Amended) The ~~method of controlling said conductivity of said Ga₂O₃ system single crystal~~ light emitting element according to claim 22, wherein a carrier concentration of said p-type β -Ga₂O₃ contact layer is greater than that of said p-type β -AlGaO₃ cladding layer, and

wherein a carrier concentration of said n-type β -Ga₂O₃ contact layer is greater than that of said n-type β -AlGaO₃ cladding layer ~~the predetermined dopant comprises one of: said p-type dopant; and an n-type dopant for controlling said conductivity of the Ga₂O₃ system single crystal.~~

24. (Currently Amended) The light emitting element ~~method of controlling a conductivity of a Ga₂O₃ system single crystal~~ according to claim [[23]] 22, wherein said active layer comprises β -GaInO₃ ~~n-type dopant comprises one of Si, Hf, Ge, Sn, Ti, and Zr.~~

25. (Currently Amended) The method of manufacturing ~~controlling a conductivity of a Ga₂O₃ system single crystal~~ according to claim [[23]] 19, wherein ~~a value of 2.0×10^{-3} to $8.0 \times 10^2 \Omega\text{cm}$ is obtained as a desired resistivity by adding a predetermined amount of said n-type dopant~~ comprises one of Si, Hf, and Sn.

26. (Currently Amended) The method of ~~forming~~ controlling a conductivity of a Ga_2O_3 system single crystal ~~[[layer]]~~ according to claim ~~[[25]]~~ 1, wherein the n-type dopant comprises one of Si, Hf, and Sn ~~a carrier concentration of the Ga_2O_3 system single crystal is controlled to fall within a range of 5.5×10^{15} to $2.0 \times 10^{19}/\text{cm}^3$ as a range of said desired resistivity.~~

27. (Currently Amended) The ~~method of controlling a conductivity of~~ a Ga_2O_3 system single crystal according to claim ~~[[22]]~~ 20, wherein said n-type dopant comprises one of Si, Hf, and Sn ~~$1 \times 10^3 \Omega\text{cm}$ or more is obtained as a desired resistivity by adding a predetermined amount of said p-type dopant.~~